

SUMMARY REPORT

A Short-Term Course on Instrumentation, Cryogenics, and Composites (ICC-2024) was held from January 3–7, 2024, by the Department of Instrumentation and Control Engineering at the National Institute of Technology, Jalandhar. There were two sessions for the event per day. The morning session ran from 10.30 AM to 12:30 PM, while the evening session ran from 2.30 PM to 4:30 PM.

Our honorable Director, Sir Prof. Binod K. Kanaujia, inaugurated the event in the presence of the Head of ICE, Er. Narinder Singh Sir, Course Convener Dr. Ravi Verma and Dr. Afzal Sikander, as well as Course Coordinators, Dr. Richa Sharma and Dr. Karan Jain.

Prof. S. Kasthuriengan Sir from IISc, Bangalore, and Dr. K.V. Srinivasan from TIFR, Mumbai, were the presenters on the first day.

The first talk of day-1 by Prof. S. Kasthuriengan Sir, was CRYOGENIC TECHNOLOGY. FUNDAMENTALS AND APPLICATIONS like how Cryogenic technology explores the behaviour of materials at extremely low temperatures, typically below -150°C . It delves into fundamental principles of physics and chemistry at these frigid conditions. Applications span various fields including medicine, where cryogenics enables tissue preservation and medical imaging; in aerospace, where it's utilized for rocket fuel storage and spacecraft cooling; and in physics research, for studying superconductivity and quantum phenomena. Its interdisciplinary nature and ability to push the boundaries of what's possibly make cryogenic technology a vital aspect of modern scientific exploration and innovation.

Dr. K.V. Srinivasan Sir's afternoon presentation covered the topic CRYOGENICS - THE PHYSICS AND ENGINEERING OF VERY LOW TEMPERATURE was discussed. He stated how Cryogenics explores the physics and engineering of ultra-low conditions, pushing boundaries in fields like medicine, physics, and aerospace. Its applications range from preserving biological samples to enabling superconductivity for advanced technologies. Understanding cryogenic principles unlocks potential breakthroughs in space exploration, quantum computing, and energy storage.

Prof. S. Kasthuriengan Sir led the morning session on the second day, explaining CRYOCOOLERS: TECHNOLOGY OF THE FUTURE. Cryocoolers represent cutting-edge technology poised to revolutionize various industries. With their potential to enhance thermal management in compact and energy-efficient systems, cryocoolers are shaping the future of technology and scientific innovation.

Dr. Upendra Behera Sir from IISc Bangalore spoke about the DESIGN AND DEVELOPMENT OF CRYOGENIC TRANSFER LINES during the second day's evening session. In his talk he discussed about design aspects for storage of cryogenic fluids, need for storage of cryogenics fluids, transfer of cryogenics fluids and probable research in the area of cryogenics transfer line.

Dr. Ashish Kumar Sir from KEK, Japan, spoke about CRYOGENICS FOR PARTICLE ACCELERATORS at the morning session on the third day. He elaborated how Cryogenics plays a pivotal role in particle accelerators, facilitating the operation of superconducting magnets critical for accelerating particles to high energies. By maintaining these magnets at

ultra-low temperatures, often near absolute zero, cryogenic systems enable them to achieve superconductivity and produce powerful magnetic fields efficiently.

Dr. Upendra Behera Sir spoke about ENERGY SEPARATION AND LIQUID OXYGEN (LOX) SEPARATION IN VORTEX at the third day's evening session, where he discussed about introduction, principle and applications of Vortex tube. The technique offers a compact and efficient means of obtaining high-purity liquid oxygen for various industrial and aerospace applications.

The topic of discussion for the fourth day's morning session was SUSTAINABLE POLYMERS AND COMPOSITES FOR INDUSTRIES: MYTH AND REALITY, delivered by Dr. Sushanta Kumar Sahoo sir from CSIR, Thiruvananthapuram. He explained that the quest for sustainable polymers and composites in industries navigates between myth and reality, as it seeks to balance environmental claims with practical applications. While advancements are made in developing bio-based, recyclable, and biodegradable materials, challenges persist in scalability, performance, and economic viability.

Dr. Kiran Singh sir from NIT Jalandhar spoke on MATERIAL PROPERTIES UNDER EXTREME CONDITIONS at the day four evening session. He demonstrated how material properties under extreme conditions are explored and how substances behave under intense pressures, temperatures, or environments. This field delves into phenomena like superconductivity, phase transitions, and mechanical behaviour in extreme environments such as outer space or deep within the Earth.

Dr. Madhab Bera, sir, of TATA Steel, Jamshedpur, spoke about topic FIBER REINFORCED POLYMER (FRP) COMPOSITES: FUNDAMENTALS AND EMERGING APPLICATIONS during the morning session of Day-5 session-1. He stated that with ongoing advancements, FRP composites find emerging applications across industries, including automotive, aerospace, infrastructure, and renewable energy, reshaping design possibilities and structural solutions.

Dr. Gaurav Gupta from VIT Vellore lectured about POLYMERS AND POLYMER COMPOSITES during the Day 5 evening session. In his presentation he explained how polymers and polymer composites are versatile materials with wide-ranging applications across industries. Polymers, long-chain molecules, offer flexibility, while composites combine them with reinforcing materials for enhanced strength and durability.

The Valedictory ceremony was held in the presence of the honorable Director, Prof. Binod K. Kanaujia Sir, following the conclusion of the evening session on day five. The participants interacted with the presenters and asked questions that were answered. At 5 PM, the STC came to an end when each participant received their e-Certificate.

What are composites???

Jartz defines "Composites are multifunctional material systems that provide characteristics not obtainable from any discrete material".

Kelly defines "Composites should not be regarded simply as a combination of two materials; the combination has its own distinctive properties".

Beghezan defines "Composites are compound materials which differ from alloys by the fact that the individual components retain their characteristics but are so incorporated into the composite as to take advantage only of their attributes and not of their short comings"

Dr. Gaurav Gupta (Presenting)

2:34 PM | uoa-jmq-bhx

Dr. Gaurav Gupta from VIT Vellore presenting about POLYMERS AND POLYMER COMPOSITES during the Day 5 evening session

RESINS (POLYMER)

"To transfer stress between the reinforcing materials and to protect them from mechanical and other external damage"

Type of Resin Polymer

- Thermoplastic**
Examples: Polyethylene, Nylons, PVC, PC, PEEK etc.
- Vitimer**
Examples: Epoxy, PLA etc. based vitimer
- Thermoset**
Examples: Epoxy, Polyester, Vinyl ester, Phenolic, Polyamide

Madhab Bera (Presenting)

10:50 AM | uoa-jmq-bhx

Dr. Madhab Bera, sir, of TATA Steel, Jamshedpur, discussing about topic FIBER REINFORCED POLYMER (FRP) COMPOSITES: FUNDAMENTALS AND EMERGING APPLICATIONS during the morning session of Day-5 session-1